

and glasses (see e.g. U.S. Patent No. 5,114,218, 5,151,600, 5,184,156 and 5,382,986 all assigned to the same assignee as the present invention) or flat panel devices to give the user control and feedback of the treatment protocol and procedure. All such variations are considered to be within the scope and spirit of the present invention as defined by the

5 following claims and their legal equivalents.

UNITED STATES PATENT AND TRADEMARK OFFICE  
DOCUMENT CLASSIFICATION BARCODE SHEET



# Claims

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Level - 2  
Version 1.1  
Updated - 8/01/01

10017287 041802

What is claimed is:

1. A multiple laser treatment apparatus, comprising:
  - (a) n lasers, wherein said  $n > 1$  and each of said n lasers simultaneously delivers a laser treatment beam selected for a treatment wherein each one of said laser treatment beams comprises at least one different laser beam parameter; and
  - (b) means to deliver said laser treatment beams in a combined treatment beam wherein said combined treatment beam is delivered at a substance at which said substance undergoes said treatment.
2. The apparatus as set forth in claim 1, wherein said laser beam parameters are wavelengths, fluences, power levels, energy levels, temporal parameters, geometrical parameters, spot sizes, linear delivery parameters or three-dimensional delivery parameters.
3. The apparatus as set forth in claim 2, wherein said wavelength is selected from a spectrum of wavelengths ranging from ultraviolet to far infrared.
4. The apparatus as set forth in claim 2, wherein said one or more laser beam parameters of said laser treatment beams are different.
5. The apparatus as set forth in claim 2, wherein said one or more laser beam parameters of said laser treatment beams are identical.

6. The apparatus as set forth in claim 1, further comprising at least one optical component to select one or more laser beam parameters of one or more of said laser treatment beams.

5 7. The apparatus as set forth in claim 6, wherein said optical component is a beam profiler, a collimator, a spherical element, an a-spherical element or a parabolic element.

10 8. The apparatus as set forth in claim 1, further comprising means to control each one of said n lasers.

9. The apparatus as set forth in claim 8, wherein said means to control comprises a single control panel.

15 10. The apparatus as set forth in claim 1, further comprising means to control one or more laser beam parameters of at least one of said laser treatment beams.

20 11. The apparatus as set forth in claim 1, wherein one or more of said n lasers is a gas laser, liquid laser, solid state laser, semiconductor diode laser, a tunable laser or a flashlight laser.

25 12. The apparatus as set forth in claim 1, further comprising at least one optical path to transmit said laser treatment beams, wherein said optical path is an optical fiber, an articulated arm or a waveguide.

13. The apparatus as set forth in claim 1, wherein said means to deliver comprises a mirror-based optical delivery system to control said combined treatment beam.
14. The apparatus as set forth in claim 13, wherein said mirror-based optical delivery system has a spot size of 0.1 mm or less.
15. The apparatus as set forth in claim 13, wherein said mirror-based optical delivery device has a spot size of 0.1 mm or more.
16. The apparatus as set forth in claim 13, wherein said optical delivery device comprises linear delivery means.
17. The apparatus as set forth in claim 13, wherein said optical delivery device comprises three-dimensional delivery means.
18. The apparatus as set forth in claim 1, wherein said means to deliver comprises a micromanipulator.
19. The apparatus as set forth in claim 1, wherein said means to deliver comprises endoscopic delivery means.
20. The apparatus as set forth in claim 1, wherein said means to deliver comprises an optical device wherein said optical device comprises:
- (a)  $n$  optical components aligned on an optical path to receive said laser treatment beams from said  $n$  lasers, wherein said laser  $n_i$  corresponds to said optical component  $n_i$  and  $i=1, \dots, n$ , and wherein each of said  $n$  optical

components directs and selectively combines said laser treatment beams of said n lasers along said optical path; and

- (b) an optical delivery system connected to said optical path to deliver said combined treatment beam to said substance.

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21. The apparatus as set forth in claim 20, wherein one or more of said n optical components is a wavelength selective mirror, a beam splitter or a wavelength selective filter.

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22. The apparatus as set forth in claim 20, further comprising means to position said n optical components in said optical path or away from said optical path.

23. The apparatus as set forth in claim 20, further comprising position means to generate a subset of combinations of said laser treatment beams.

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24. The apparatus as set forth in claim 1, wherein said substance is a biological tissue, a chemical compound, a biochemical compound, a food product, a fluid, a bioengineering composition or a physical structure.

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25. The apparatus as set forth in claim 1, wherein said treatment is a medical treatment and said laser treatment beams are medically useful treatment beams.

26. The apparatus as set forth in claim 1, further comprising means for diagnosing said substance.

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27. The apparatus as set forth in claim 26, wherein said diagnosing means comprises a diagnostic system, wherein said diagnostic system maps an area of said substance using fluorescent emission.

5 28. The apparatus as set forth in claim 1, wherein said apparatus is a handheld delivery apparatus.

29. The apparatus as set forth in claim 28, wherein said handheld delivery apparatus is a portable and transferable miniature handheld delivery apparatus with dimensions of 6" by 12" by 20" or less.

30. The apparatus as set forth in claim 1, wherein said apparatus operates on independent power.

15 31. A multiple laser treatment apparatus, comprising:

- (a) means to select two or more laser treatment beams selected for a treatment wherein each one of said laser treatment beams comprises at least one different laser beam parameter; and
- (b) means to simultaneously deliver said laser treatment beams in a combined laser treatment beam at a substance at which said substance undergoes said treatment.

20 32. The apparatus as set forth in claim 31, wherein said laser beam parameters are wavelengths, fluences, power levels, energy levels, temporal parameters, geometrical parameters, spot sizes, linear delivery parameters or three-dimensional delivery parameters.

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33. The apparatus as set forth in claim 31, wherein said means to select comprises at least one optical component to select one or more of said laser beam parameters of one or more of said laser treatment beams.

5 34. The apparatus as set forth in claim 31, wherein said means to select comprises means to control said laser beam parameters.

35. The apparatus as set forth in claim 31, wherein said means to deliver comprises a mirror-based optical delivery system to control said combined treatment beam.

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36. The apparatus as set forth in claim 35, wherein said mirror-based optical delivery system has a spot size of 0.1 mm or less.

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37. The apparatus as set forth in claim 35, wherein said mirror-based optical delivery device has a spot size of 0.1 mm or more.

38. The apparatus as set forth in claim 35, wherein said optical delivery device comprises linear delivery means.

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39. The apparatus as set forth in claim 35, wherein said optical delivery device comprises three-dimensional delivery means.

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40. The apparatus as set forth in claim 31, wherein said means to deliver comprises a micromanipulator.



41. The apparatus as set forth in claim 31, wherein said means to deliver comprises endoscopic delivery means.

42. The apparatus as set forth in claim 31, wherein said means to deliver comprises an optical device to combine said laser treatment beams.

43. The apparatus as set forth in claim 31, further comprising means for diagnosing said substance.

44. The apparatus as set forth in claim 43, wherein said diagnosing means comprises a diagnostic system, wherein said diagnostic system maps an area of said substance using fluorescent emission.

45. A method for simultaneously delivering a combined laser treatment beam, comprising the steps of:

- (a) selecting two or more laser treatment beams selected for a treatment wherein each one of said laser treatment beams comprises at least one different laser beam parameter; and
- (b) simultaneously delivering said laser treatment beams in a combined laser treatment beam at a substance at which said substance undergoes said treatment.

46. The method as set forth in claim 45, wherein said laser beam parameters are wavelengths, fluences, power levels, energy levels, temporal parameters, geometrical parameters, spot sizes, linear delivery parameters or three-dimensional delivery parameters.

47. The method as set forth in claim 45, wherein said step of selecting comprises the step of providing at least one optical component to select one or more of said laser beam parameters of one or more of said laser treatment beams.

5 48. The method as set forth in claim 45, wherein said step of selecting comprises the step of controlling said laser beam parameters.

49. The method as set forth in claim 45, wherein said step of simultaneously delivering comprises the step of providing a mirror-based optical delivery system to control said combined treatment beam.

50. The method as set forth in claim 49, wherein said optical delivery device comprises linear delivery means.

51. The method as set forth in claim 49, wherein said optical delivery device comprises three-dimensional delivery means.

52. The method as set forth in claim 45, wherein said step of simultaneously delivering comprises the step of providing a micromanipulator.

53. The method as set forth in claim 45, wherein said step of simultaneously delivering comprises the step of providing endoscopic delivery means.

54. The method as set forth in claim 45, wherein said step of simultaneously delivering comprises the step of providing an optical device to combine said laser treatment beams.

55. The method as set forth in claim 45, further comprising the step of providing means for diagnosing said substance.

5 56. The method as set forth in claim 55, wherein said diagnosing means comprises a diagnostic system, wherein said diagnostic system maps an area of said substance using fluorescent emission.

10 57. A computer program to manage and control a simultaneous delivery of multiple laser treatment beams to a substance, comprising:

- 15 (a) means for selecting a treatment plan wherein said treatment plan comprises two or more laser treatment beams wherein each one of said laser treatment beams comprises at least one different laser beam parameter; and
- (b) means for applying said treatment plan to said substance.

58. The computer program as set forth in claim 57, wherein said means for selecting comprises means for recommending said treatment plan.

20 59. The computer program as set forth in claim 57, wherein said means for selecting comprises a database of treatment plans.

25 60. The computer program as set forth in claim 57, wherein said means for selecting comprises means for comparing said treatment plan with a previous treatment plan.

61. The computer program as set forth in claim 57, further comprising means for entering data.

62. The computer program as set forth in claim 61, wherein said data comprises patient data, treatment plan data, or complaint or disease data.

63. The computer program as set forth in claim 57, further comprising means for verifying said treatment plan.

64. The computer program as set forth in claim 57, further comprising communication means to communicate information between said computer program and one or more remote stations.

65. A database of a plurality of laser treatment plans wherein two or more laser treatment beams are delivered simultaneously to a substance, comprising:

- (a) said plurality of treatment plans; and
- (b) said one or more laser beam parameters for each one of said treatment plans wherein each one of said laser treatment beams comprises at least one different laser beam parameter.

66. The database as set forth in claim 65, wherein said treatment plans are medical treatment plans, chemical treatment plans, biochemical treatment plans, bioengineering treatment plans or physical treatment plans.

67. The database as set forth in claim 65, further comprising substance-related information.

68. The database as set forth in claim 65, further comprising patient-related information.

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